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10/541,936	07/08/2005	Dharam Pal Gosain	S1459.70079US00	8482

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EXAMINER	
PERRY, ANTHONY T	
ART UNIT	PAPER NUMBER
2879	
MAIL DATE	DELIVERY MODE
10/05/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/541,936	GOSAIN ET AL.	
	Examiner	Art Unit	
	ANTHONY T. PERRY	2879	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 January 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-49* is/are pending in the application.

4a) Of the above claim(s) *6-8* is/are withdrawn from consideration.

5)☒ Claim(s) *25-27* is/are allowed.

6)☒ Claim(s) *1-5,12-14,16,24,28-31,34,35 and 37-49* is/are rejected.

7)☒ Claim(s) *9-11,15,17-23,32,33 and 36* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 July 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/8/5,10/15/07,11/15/07,12/24/08,2/06/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Applicant's election without traverse of species I (claims 1-5 and 9-49) in the reply filed on 1/06/09 is acknowledged.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 24, 41-43 and 47-49 are rejected under 35 U.S.C. 102(b) as being anticipated by Shin et al. (JP 2002-289086).

Regarding claim 1, Shin et al. disclose a method of manufacturing a tubular carbon molecule comprising: a catalyst arranging step of arranging a metal having a catalyst function for a tubular carbon molecule through the use of melting by a modulated heat distribution; and a growing step of growing a tubular carbon molecule (for example, see paragraphs 0009 and 0034).

Regarding claim 24, Shin et al. disclose a tubular carbon molecule, being formed through arranging a metal having a catalyst function for a tubular carbon molecule through the use of melting by a modulated heat distribution and growing a tubular carbon molecule through the use of the metal having the catalyst function (for example, see paragraphs 0009 and 0034).

Regarding claim 28 Shin et al. disclose a method of manufacturing a field electron emission device, comprising: a catalyst arranging step of arranging a metal having a catalyst function for a tubular carbon molecule on a substrate through the use of a modulated heat

distribution; and a cathode forming step of forming a cathode through growing a tubular carbon molecule (for example, see Fig. 2 and paragraphs 0009, 0012-0013, and 0034).

Regarding claim 30, Shin et al. disclose a method of manufacturing a field electron emission device according to claim 28, wherein the substrate (1) has a planar pattern made of the metal (7) for example, see Fig. 1).

Regarding claims 41-42, Shin et al. disclose a method of manufacturing a field emission device according to claim 28 further comprising: an extraction electrode forming step of forming an extraction electrode (2) corresponding to the cathode (8), wherein the extraction electrode forming step (Fig. 1(d)) is carried out between the catalyst arranging step (Fig. 1(c)) and the cathode forming step (Fig. 1(d)) (for example, see Fig 1).

Regarding claim 43, Shin et al. disclose the method of manufacturing a field electron emission device according to claim 41, wherein the extraction electrode forming step includes: an insulating film forming step of forming an insulating film (4) on the substrate (1); a conductive film forming step of forming a conductive film (2) on the insulating film (4); and an aperture portion forming step of forming an aperture portion in the insulating film (4) and the conductive film (2) corresponding to the cathode (8) (for example, see Figs 1 and 2).

Regarding claim 47, Shin et al. disclose a field electron emission device, comprising: a cathode which includes a tubular carbon molecule grown through the use of a metal having a catalyst function for a tubular carbon molecule arranged on a substrate (1) through the use of melting by a modulated heat distribution (for example, see Fig. 2 and paragraphs 0009, 0012-0013, and 0034).

Regarding claim 48, Shin et al. disclose a method of manufacturing a display unit, wherein a step of forming the field electron emission device includes: a catalyst arranging step of

arranging a metal having a catalyst function for a tubular carbon molecule on a substrate through the use of melting by a modulated heat distribution; and a cathode forming step of forming a cathode through growing a tubular carbon molecule (for example, see paragraphs 0009, 0012, and 0034). The display unit includes a light emitting portion (72) which emits light according to collision of electrons emitted from the field electron emission device (see Fig. 7).

Regarding claim 49, Shin et al. disclose a display unit, comprising: a field electron emission device; and a light emitting portion (72) which emits light according to collision of electrons emitted from the field electron emission device, wherein the field electron emission device includes a cathode which includes a tubular carbon molecule (8) grown through the use of a metal having a catalyst (6) function for a tubular carbon molecule arranged on a substrate (1) through the use of melting by a modulated heat distribution (for example, see Figs. 2 and 7 and paragraphs 0009, 0012-0013, and 0034).

Claims 1, 12-14, 16 are rejected under 35 U.S.C. 102(b) as being anticipated by NPL document entitled "Carbon nanotube films grown by laser assisted chemical vapor deposition".

Regarding claim 1, the NPL document discloses a method of manufacturing a tubular carbon molecule comprising: a catalyst arranging step of arranging a metal having a catalyst function for a tubular carbon molecule through the use of melting by a modulated heat distribution; and a growing step of growing a tubular carbon molecule (for example, see page 803).

Regarding claim 12, the NPL document discloses a method of manufacturing a tubular carbon molecule according to claim 1, wherein the catalyst arranging step includes: a melting step of applying a modulated heat distribution to a surface of a material substrate including a second material as an additive in a first material so as to melt the surface of the material

substrate; and a depositing step of depositing the second material in a position corresponding to the heat distribution through dissipating the heat of the surface of the material substrate (for example, see pages 803 and 808-809).

Regarding claim 13, the NPL document discloses a method of manufacturing a tubular carbon molecule according to claim 12, wherein the second material is a material which lowers the melting point of the first material by adding the second material to the first material (for example, see page 803).

Regarding claim 14, the NPL document discloses a method of manufacturing a tubular carbon molecule according to claim 12, wherein in the depositing step, the second material is deposited on the surface of the material substrate in a planar shape through dissipating the heat of the surface of the material substrate.

Regarding claim 16, the NPL document discloses a method of manufacturing a tubular carbon molecule according to claim 12, wherein the first material is a semiconductor or a metal, and the second material is a metal having a catalyst function (for example, see page 803).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 29, 31, 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shin et al. (JP 2002-289086).

Regarding claim 29, Shin discloses a method of manufacturing a field electron emission device according to claim 28, but does not specifically state that during the cathode forming step,

the substrate and an electrode face each other, and an electric field is applied between the substrate and the electrode. However, arc discharge is a known method for growing carbon nanotubes used for a cathode in a field emission device. The arc discharge method applies an electric field to a substrate and an electrode that are facing each other to grow carbon nanotubes used as the cathode of field emission device. It has been held to be within the general skill of a worker in the art to select a known method on the basis of its suitability for the intended use as a matter of obvious design choice. Thus, it would have been obvious to one having ordinary skills in the art at the time the invention was made to have reasonably contemplated using the arc discharge method for the cathode forming step, since the selection of known materials for a known purpose is within the skill of the art.

Regarding claim 31, Shin discloses a method of manufacturing a field electron emission device according to claim 28, but does not specifically recite the substrate having a pattern of a projection in which at least a tip portion thereof is made of the metal. However, using a pattern having a projection formed thereon is well known in the art. By providing a projection on which the carbon nanotubes are grown from the metal (catalyst) on a tip portion of the projection allows for a greater field emission current at a lower voltage. Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to such an arrangement including a metal on a tip portion of a projection, so that the cathode can be driven at a lower voltage, providing a more power efficient field emission display.

Regarding claims 34-35, Shin discloses a method of manufacturing a field electron emission device according to claim 28, but does not specifically recite the spacing of the metal. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. It would have

been obvious to one having ordinary skill in the art at the time the invention was made to provide an appropriate spacing for the metal (cathodes) based on desired properties of the display, since optimization of workable ranges is considered within the skill of the art.

Claims 2 and 37-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shin et al. (JP 2002-289086) in view of Nagata et al. (US 5,072,091).

Regarding claim 2, Shin does not specifically recite the heat distribution being applied through diffracting an energy beam in a one-dimensional direction or a two-dimensional direction. However, Nagata teaches applying heat distribution through diffracting an energy beam in a one-dimensional direction or a two-dimensional direction as a cost effective method for altering/patterning a metal material layer (for example, see col. 2, lines 10-35). Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the heat distribution method disclosed by Nagata in order to efficiently arrange the catalyst particles in a desired pattern on the substrate of the device taught by Shin.

Regarding claims 37-40, Shin does not specifically recite a separation groove forming step. However, it is well known in the art to provide a spacing (separation groove) between the metal layers (cathode electrodes) so as to ensure that the cathodes are electrically separated to prevent a short circuit in the device. Nagata teaches that the method of diffracting an energy beam in a one-dimensional direction or a two-dimensional direction is a cost effective method for altering/patterning a metal material layer. Nagata et al. teach a method of patterning a metal layer by forming separation grooves through irradiation by diffracting an energy beam in a one-dimensional or a two-dimensional direction providing a separation groove in the form of parallel lines or a grid pattern (for example, see col. 2, lines 10-35). Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the heat

distribution method disclosed by Nagata in order to efficiently arrange the catalyst particles in a desired pattern on the substrate of the device taught by Shin.

Claims 3-5 and 44-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shin et al. (JP 2002-289086) in view of Jin et al. (EP 1022763).

Regarding claims 3-5 and 44-46, Shin does not specifically recite a height equalizing step. However, Jin teaches a height equalizing step of forming a tip of the tubular carbon molecule in a predetermined plane, wherein in the height equalizing step, after a fixing layer is formed at least around the tubular carbon molecule to fix the tubular carbon molecule, and performing chemical mechanical polishing on the tubular carbon molecule together with the fixing layer, thereby forming the tip into an open tip. Jin teaches that by performing such a height equalizing step that the height uniformity increases the number of participating nanotubes (for example, see the abstract). Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the height equalizing method taught by Jin in order to provide an more light efficient display.

Allowable Subject Matter

Claims 25-27 are allowed.

Claims 9-11, 15, 17-19, 20-23, 32, and 36 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record fails to disclose or fairly suggest:

- An inserting step, wherein magnetic material is inserted in the open tips of a plurality of tubular carbon molecules, in combination with the remaining claimed

limitations as called for in claim 9 (claims 10-11 would be allowable for the same reasons since they are dependent on claim 9);

- The depositing step, wherein a projection is formed on the surface of the material substrate through dissipating the heat of the surface of the material substrate, and the second material is deposited on at least a tip portion of the projection, in combination with the remaining claimed limitations as called for in claim 15;
- The catalyst arranging step comprising: a melting step of applying a heat distribution modulated according to a desired pattern to a surface of a material substrate so as to melt the surface of the material substrate; a master forming step of forming a projection in which at least a tip portion thereof is made of a transfer material in a position corresponding to the heat distribution on the material substrate through dissipating the heat of the surface of the material substrate so as to form a master for transfer having a pattern of the projection on a surface thereof; and a transferring step of forming a substrate through transferring the pattern of the master for transfer to a substrate to be transferred, and the tubular carbon molecule is grown on the substrate, in combination with the remaining claimed limitations as called for in claim 17 (claims 18-19 would be allowable for the same reasons since they are dependent on claim 17);
- The catalyst arranging step comprising: a projection forming step of forming a projection of a pattern in a position corresponding to the heat distribution through dissipating the heat of the surface of the material substrate; and an adhering step of adhering a catalyst metal to a tip portion of the projection through pushing a metal substrate made of a metal having a catalyst function for a tubular carbon

molecule to the projection, in combination with the remaining claimed limitations as called for in claim 20;

- The catalyst arranging step comprising: a projection forming step of forming the pattern of a projection in a position corresponding to the heat distribution through dissipating the heat of the surface of the material substrate; and a planarizing step of planarizing the top surface of the projection, in combination with the remaining claimed limitations as called for in claim 21 (claim 21 would be allowable for the same reasons since it is dependent on claim 21);
- The catalyst arranging step includes: a melting step of applying a heat distribution modulated according to a desired pattern to a surface of a material substrate so as to melt the surface of the material substrate; a projection forming step of forming the pattern of a projection in a position corresponding to the heat distribution through dissipating the surface of the material substrate; and a control layer forming step of forming a control layer which retards the growth of a tubular carbon molecule on a surface of the projection except for an extreme tip portion, in combination with the remaining claimed limitations as called for in claim 23;
- A catalyst arranging step of arranging a metal having a catalyst function for a tubular carbon molecule through the use of melting by a modulated heat distribution; a growing step of growing a tubular carbon molecule; a height equalizing step of forming a tip of the tubular carbon molecule in a predetermined plane, and forming the tip into an open tip; and an inserting step of inserting a magnetic material in at least a tip portion of the tubular carbon molecule from the open tip, in combination with the remaining claimed limitations as called for in

claim 25 (claims 26-27 are allowable for the same reasons since they depend from claim 25);

- A method of manufacturing a field electron emission device, wherein in the cathode forming step, two of the substrates are disposed so that the patterns of the projection face each other, and an electric field is applied between the two substrates, in combination with the remaining claimed limitations as called for in claim 32;
- A method of manufacturing a field electron emission device, wherein an electrode including a pattern of projections corresponding to the pattern form on the substrate is used, and the pattern of the substrate and the pattern of the projections of the electrode face each other, in combination with the remaining claimed limitations as called for in claim 33;
- A method of manufacturing a field electron emission device, wherein the catalyst arranging step includes: a projection electrode forming step of forming a pattern of a projection on a surface of a flat electrode through the use of a heat distribution modulated according to a desired pattern so as to form a projection electrode; and a reducing/depositing step of forming a pattern which is made of a metal having a catalyst function and corresponds the projection electrode on the substrate through applying an electric field between the projection electrode and a conductive substrate in a catalyst solution including a metal having a catalyst function to reduce and deposit the metal, in combination with the remaining claimed limitations as called for in claim 36.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to *Anthony Perry* whose telephone number is **(571) 272-2459**. The examiner can normally be reached between the hours of 9:00AM to 5:30PM Monday thru Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel, can be reached on (571) 272-2457. **The fax phone number for this Group is (571) 273-8300.**

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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